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Whatever their Qualifications were before, whether a Preacher, a Reader of Prayers . . . or a Bellows-blower, or Nothing at all, it matters not much, for at once, in the twinkling of an Eye, as it were, after a Miraculous manner, they can mount from the profundity of Ignorance to the Pinnacles of Knowledge; from the Abyss of Nothing, to the Altitude of being Doctors of Physic, intruding into our Business with all the Impudence imaginable, to the great Abuse and Scandal of the Medical Art.

But the point which Dr. Taylor wishes to press home is that the enormous spread of these irregular practises at the confines of the medical art is permitted by the failure of teaching bodies to adjust their curriculums in harmony with the fullest requirements of the community.

The profession at large is rising to a clear recognition of its widening responsibilities in the broadest social and even political relationships. The medical schools are still bound by the traditions of medical education as it was thirty years ago.

So far as psychiatry and this country are concerned, we hope that the successive resolutions of the Medico-Psychological Association and the British Medical Association will not be in vain, and that ere long thorough tuition in all branches of psychological medicine will be offered by every medical school. For the broader issues of Dr. Taylor's discourse we would refer readers to the article itself, but it is pertinent to the occasion to say here that he prophesies the development of an elective system of medical education.

It is not to be doubted that the wasteful method of demanding a detailed course in surgery, for example, from the prospective internist, or of obstetrics from the future bacteriologist, will give place to a more rational conception of the use of time. An elective system modified to meet the special demands of the situation is an inevitable outcome of the present state of affairs if our medical schools are to be the centers of educational activity which their equipment justifies.

In the foregoing we have of set purpose attempted merely to adumbrate the changing relations between the profession and the public as indicated by isolated instances selected from an address which should be read in its en-

tirety. Although descriptive of American conditions and intended for American ears, Dr. Taylor's address is in some degree applicable to this country. The same changes are observable, and there is the same need for constant readjustment of medical teaching to meet these changes. Nebulous as yet, the altering conceptions of the functions and practical duties of the medical man may take this or that shape, may be guided by a united profession into fertilizing rains or crystallized by one-sided legislation into the first snows of the winter of our discontent. Readers of the deeply interesting correspondence in our columns upon proposed legislative changes will have observed the sharp cleavage of opinion even amongst medical men upon these proposals. It is outside the purpose of this article to discuss these matters, but it is evident that if the profession is to secure in the future the just reward of its labors and to maintain its rights in the approaching conflict between individualism and collectivism, it must frankly recognize the altering status of the medical man in the social economy, decide upon a common plan of action to meet changing conditions, and present a solid front to all attempts to encroach upon its legitimate territory.—*The British Medical Journal*.

SCIENTIFIC BOOKS

A History of the Logarithmic Slide Rule and Allied Instruments. By FLORIAN CAJORI, Ph.D.

The slide rule enjoys a wide popularity, being employed in practically all of the large engineering schools in addition to its use by practising engineers. Parenthetically it may be safely asserted that mathematicians in general do not avail themselves of the services of this instrument. Because of the wide use, such a history as this by Professor Cajori of the gradual development of the slide rule through the course of three centuries should appeal to a large circle of readers. While written in popular style for this larger class of readers and not primarily for the historian of science, yet the work bears evidence of considerable research in the literature of the

subject. In consequence it appeals also to those interested in the history of mathematics.

A brief résumé of the conclusions reached is in place, especially because of the fact that the most important result of Professor Cajori's investigation appears in the addenda, having no mention either in the preface (which in every well ordered book should be written after all the addenda are completed), nor in the index.

In 1620, only six years after the publication of Napier's "*Mirifici logarithmorum canonicis descriptio*," Edmund Gunter, who was professor of astronomy in Gresham College, London, designed a logarithmic scale of numbers, in which the numbers 1, 2, 3, . . . 10 (not "digits," however, as Cajori has it), are placed upon it in such a way that the ratio of the distance from the point 1 to the point 2 to the distance from point 1 to any other point equals the ratio of the logarithm of 2 to the logarithm of the number of the other point, *i. e.*, distances are taken proportional to the logarithms of the corresponding numbers. Compasses were used to take off distances, thus serving the purpose of the slide. The writer who did most in spreading information about Gunter's "logarithmic line of numbers" was an English lawyer Edmund Wingate, 1593-1656, to whom the invention of the slide rule has frequently been erroneously attributed, as occurs indeed in the text of the work under discussion.

Some time before 1630 William Oughtred, a preacher known as the inventor of the symbol \times for multiplication and the proportion symbol $::$, devised two rules to be applied to each other, obviating the necessity of the compasses. Oughtred further placed such logarithmic lines upon concentric circles, one circle being movable. In place of the slider a pair of pointing radii were used. Oughtred explained his invention in 1630 to his pupil William Forster, who in 1632 made it public in a book entitled "*The Circles of Proportion and the Horizontall Instrument*." In 1633 Forster published an addition with an appendix, "*The Declaration of the Two Rulers for Calculation*." The sliding feature seems to have been effected in 1657 by the surveyor

Seth Partridge, although not explained in print until 1672. The first runner was constructed by John Robertson (1712-76), a teacher of mathematics. Robertson's work was published two years after his death by one William Mountaine.

Of recent improvements noteworthy is the fact brought here to the attention of American readers that the Mannheim type of slide rule, now in use in America, is being supplanted in France by the *règle des écoles*, a slide rule with somewhat simpler arrangement of the scales affording greater accuracy.

Forster's account of his conversation with Oughtred is worth repeating. He says:

I wondered that he could so many yeares conceale such useful inventions, not onely from the world, but from my selfe, to whom in others parts and mysteries of Art he had bin so liberall. He answered, That the true way of Art is not by Instruments, but by Demonstration: and that it is a preposterous course of vulgar Teachers, to begin with Instruments and not with the Sciences, and so instead of Artists to make their Schollers only doers of tricks, and as it were Juglers: to the despite of Art, losse of precious time, and betraying of willing and industrious wits unto ignorance, and idlenesse.

Newton's employment of logarithmic scales for the solution of cubic and biquadric equations is of interest. Professor Cajori ascribes to Newton the first suggestion of a "runner" because Newton's explanation requires that straight lines be drawn across two scales. Oughtred's sliding radii would seem to have a better claim.

The statement is made (p. 45) that the author has failed to find any references to Sauveur, Camus and Clairaut in French works of the eighteenth century. Bion's "*Traité de la Construction et des principaux Usages des Instruments*" refers to Sauveur as the inventor of a logarithmic gauge, explaining the instrument and giving a cut of it. Further the author remarks (p. 46) that, "so far as we have observed, the early English designers of slide rules (Wingate, Oughtred, Partridge, Coggeshall, Everard) are never mentioned by continental writers of the eighteenth century." But Montucla ("*Histoire de Mathématique*," Paris, 1799) mentions

Gunther, Wingate, Oughtred, Forster and Partridge. Heilbronner ("Historia Mathematicos Universæ," Leipzig, 1742) includes Wingate and Gunter, while La Lande ("Astronomie," Paris, 1792) refers to Gunter as known for his scale of logarithms. These from the limited works at my hand that would be likely to mention these men.

Gunter's "Description and Use of the Sector, Cross-staff, and other Instruments," London, 1624 (p. 2), should be, according to the British Museum Catalogue, "The description use of the sector, crosse-staffe, and other instruments." The printed title page of a copy in the British Museum is dated 1623. "Horizontal" in the title of Forster's work (p. 11) should be "Horizontal," and the title of Wingate's publication (p. 9) should begin with "The." I note three "λ"s in the Greek word in footnote on page 21. There are omissions in the index, *e. g.*, Mehmke and other names of the preface. Perry and Segner (preface, page iii) are hardly entitled to be called "advanced mathematicians." The given bibliography of the slide rule receives undue prominence as it is by no means complete, a fact shown by the most casual reference to the articles on the slide rule in the "International Catalogue of Scientific Literature, Mathematics," and to the Royal Society of London's "Catalogue of Scientific Papers, Subject Index, Pure Mathematics."

Especially worthy of commendation are the abundant photographic reproductions of diagrams from the originals. The most serious criticism to be brought against this publication is that it was placed upon the market with such important corrections in the addenda. Doubtless it would have been expensive to correct the fundamental errors in the text shown by the results stated in the addenda, yet the value of the work is considerably lessened by this omission. The publishers state in a footnote that copy of the addenda was received after the text was printed. It is to be hoped that some time an edition may appear in which these important conclusions are embodied in the text.

L. C. KARPINSKI

Birds of South Carolina. By ARTHUR TREZEVANT WAYNE, Honorary Curator of Birds in the Charleston Museum. With an introduction by PAUL M. REA, Director. Contributions from the Charleston Museum, I. 8vo, pp. xxi + 254. Charleston, S. C. 1910.

The present work is based primarily on the personal observations of the author continued for nearly thirty years, mainly in the coast region of the state, to which it was his intention originally to limit its scope. The introduction by Professor Rea, based largely on manuscripts furnished by the author, whose prolonged illness rendered this assistance necessary, treats of the physical divisions of South Carolina, and the history of South Carolina ornithology, which begins with Catesby's "The Natural History of Carolina, Florida, and the Bahama Islands," published in two folio volumes in 1731-48. The later contributions, by various authors, are duly noted. The main body of the work consists of a systematic list of the "Birds of the Coast Region" (pp. 1-204; 309 species), followed by an annotated list of additional species from the interior of the state (pp. 205-213; 28 species), and a "Hypothetical List" (pp. 215-222; 22 species). A bibliography of about 200 titles and a good index complete the volume.

As a faunistic contribution, it is a work of high value, the species of the coast region being not only very fully annotated, but the annotations present a summary of the long field experience of a conscientious and exceptionally careful and competent observer, enthusiastically interested in his work. The records made by other authors are not neglected and loose or erroneous statements receive critical attention. Mr. Wayne has largely, for many years at least, had this especially interesting field almost to himself, and since about 1886 has added over thirty species to the known fauna of the region and contributed a long list of minor papers on its birds. In bringing together in a handy volume the results of his ornithological observations, he has rendered a grateful service to his